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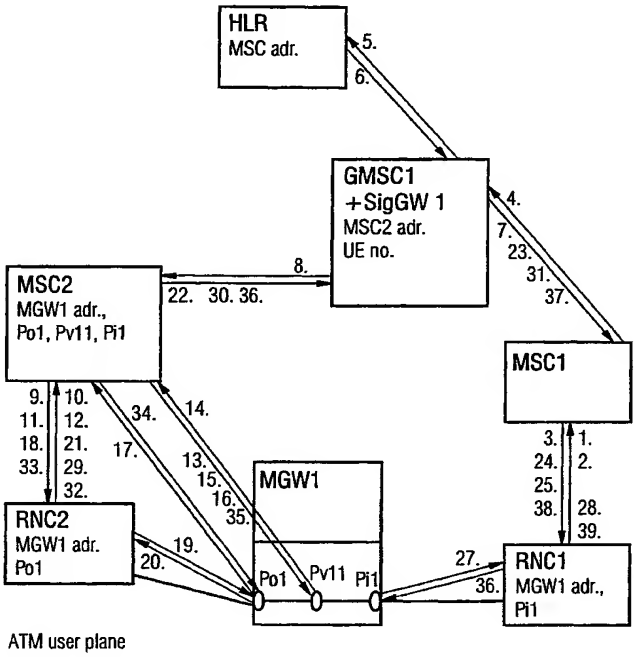
(54) Title: IMPLEMENTATION OF CALL SETUP PROCEDURES WITH SEPARATION OF CALL CONTROL AND BEARER CONTROL



(57) Abstract: The present invention relates to enabling and optimizing call setup in a telecommunication network with separated call control and bearer control, i.e., payload transmission. The separation of call control and payload transmission means that the signaling between control nodes like mobile services switching centres, GMSCs and TSCs takes a different route through the network than the payload. This enables the telecommunication network to perform an optimal routing for the payload, using a minimum of resources. Depending on the call case, originating call, terminating call, internal call or transit call, there are only one or maximally two media gateway necessary.

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IMPLEMENTATION OF CALL SETUP PROCEDURES WITH SEPARATION OF CALL CONTROL AND BEARER CONTROL

BACKGROUND OF THE INVENTION

A conventional GSM (Global System for Mobile Communications) or UMTS (Universal Mobile Telecommunications Service) core network uses bearer control and call control. The bearer control is the aspect of signaling related to the control of the selection of a path through the transmission network and utilizing (reserving, releasing and setting up) the required resources. The call control is the aspect of signaling related to the subscriber and service control, taking, e. g., the subscriber state into consideration.

In the existing implementations of N-ISDN (Integrated Services Digital Network) the call control and the bearer control are integral with one another. A user plane is associated directly with the control servers, such as MSCs(Mobile Services switching Centers) and GMSCs (Gateway MSCs). Thus, the control nodes implement both, application logic for signaling and the user plane.

The present invention is directed to separation of the call control and the bearer control.

Summary of the Invention

For implementation of GSM and UMTS core networks there is a new approach to separate call control and bearer control.

In accordance with the invention, with the implementation of separation between call and bearer control, the following features are described:

Transfer the media gateway address, a termination and possibly the chosen transcoder in a backward direction.

The application software is independent from the used transmission technology, e. g. STM, ATM, IP.

Changes to call control and bearer control signaling to achieve the optimized user plane set up.

Usage of logical points in the MGW to allow different control servers to use one media gateway.

Giving an mobile services switching centre, TSC server the possibility to control several media gateways by allocating one PC (Point Code) per media gateway in the control node.

The user plane routing for call setup is optimized significantly.

The user plane routing for supplementary services CFNREA, CFB, CFNRY, CFU is optimized significantly.

The user plane routing for supplementary services CW, HOLD is optimized significantly.

As in the IAM, optionally, a CODEC list can be included, which had been negotiated between the originating mobile services switching centre MSC1 and a user equipment1, the terminating mobile services switching centre MSC2 can negotiate a CODEC with user equipment 2, which it can signal back via the mobile services switching centre MSC1 to user equipment 1. By that user equipment 1 and user equipment 2 use the same CODEC, which avoids CODECs in the network

giving better quality. In the case that CODECs are necessary within the network, e. g., STM (see Fig. 7) CODECs of equal type can be chosen, allowing TFO.

A media gateway is chosen by the first control node, which needs to modify the user plane, and not before.

A chosen media gateway MGW1 can be linked out, when a later call control server mobile services switching centre MSC2 chooses a different media gateway MGW2 and reports this to the first control server. The first call control server sets up the user plane towards the different media gateway MGW2.

Allowing of pooling of conference call devices in media gateways.

Combining different coded speech streams to one MPTY.

Further features and advantages of the invention will be readily apparent from the following specification and the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram illustrating basic call setup for a call from user equipment to user equipment, media gateway address being transported in the backward direction;

Figure 2 is a block diagram illustrating basic call setup for a call to user equipment, media gateway address being transported in the backward direction;

Figure 3 is a block diagram illustrating basic call setup for a roaming call to user equipment in own PLMN, media gateway address being transported in the backward direction;

Figure 4 is a block diagram illustrating basic call setup for call forwarding in GMSC to ISDN no., media gateway address being transported in the backward direction;

Figure 5 is a block diagram illustrating basic call setup for a call from user equipment with call forwarding in GMSC to user equipment, media gateway address being transported in the backward direction;

Figure 6 is a block diagram illustrating basic call setup for call waiting and accepting the waiting call in one media gateway, media gateway address being transported in the backward direction; and

Figure 7 is a block diagram illustrating basic call setup for roaming user equipment call leg in home PLMN and roaming user equipment call leg in visitor PLMN, media gateway address being transported in the backward direction.

Description

The present invention relates to enabling and optimizing call setup in a telecommunication network with separated call control and bearer control, i.e., set up of a payload connection. The separation of call control and payload transmission means that the signaling between control nodes like mobile services switching centres, gateway mobile services switching centres and transit switching centres takes a different way through the network than the payload. This enables the telecommunication network to perform an optimal routing for the payload, using a minimum of resources. Depending on the call case, originating call, terminating call, internal call or transit call, there are only one or maximally two media gateway necessary within a network.

The invention particularly relates to a method comprising the transmission of an identification of a selected media gateway in a backward direction. That is, the second control node or a further control node selects the media gateway depending on:

- the call origin;
- the call destination (important for the selection of the terminating control node transit switch or mobile services switching centre, and for the coding decoding); or
- the required service (voice, fax or else),

for all call cases. In some call cases, further information can be relevant for the selection of an media gateway, such as:

- the invoked service, e.g. CFB;
- the coding of the payload (in the case of compressed voice it is sensible to keep the voice data compressed throughout the network to save transmission capacity);
- the framing of the calls.

The invention herein relates to implementation of basic call setup, GSM/UMTS supplementary services CFU, CFB, CFNREA, CFNRY, CW, HOLD and MPTY with transporting a transport layer address, a logical point, the chosen coding type and the chosen framing type in a backward direction in cellular networks with separation of call control and bearer control. Call setup is described in various traffic cases, each illustrated in one of the figures. Each of the figures is a block diagram of a wireless communication system, such as a GSM or UMTS core network, with directional arrows illustrating control signaling between control servers and with media gateways during call setup for the different traffic cases. The written description herein describes information conveyed in each signal. The particular signal is identified herein and in the drawing with a reference numeral.

Many of the calls in the traffic cases described herein involve a fixed terminal or a mobile terminal. Terminals can be, for example, a personal computer, a

fax, or a phone that is located within the network. Such a mobile terminal is referred to herein as User Equipment (UE). The user equipment communicates with the network via an RNC (Radio Network Controller) using Radio Resource Control (RRC) protocol.

A logical point is a reference locally generated by an MGW (Media Gateway) and only with the media gateway address valid to identify a connection in the control servers e. g. MSC/VLR (MSC/Visitor Location Register), GMSC, TSC and in the RNC. For this purpose a logical point P in a first media gateway MGW1 is reserved. This reserved point is sent back in a DCP resource response message to the control server and passed on from this control server to another media gateway MGW2 or RNC, which shall set up an AAL2 connection. In this set up the logical point P is included to identify to which reserved resource in a media gateway MGW1 the connection shall be set up. The logical point is equivalent to a termination used in the H.GCP protocol standardized by ITU.

A control node, such as one of the control servers, discussed above, provides the application logic. The strict separation of the application logic from the user plane handling allows intensive application development and execution. In the described system the control nodes GMSC, MSC, TSC and HLR (only signaling) exist. The interfaces of the control nodes are, e.g., N-ISUP, for call control signaling, DCP signaling for media gateway control and MAP for transferring signaling between control servers.

A control node, such as one of the control servers, discussed above, provides the application logic. The strict separation of the application logic from the user plane handling allows intensive application development and execution. In the described system the control nodes GMSC, MSC, TSC and HLR (only signaling)

exist. The interfaces of the control nodes are, e. g., N-ISUP, for call control signaling, DCP signaling for media gateway control and MAP for transferring connectionless signaling between control servers.

A media gateway (MGW) modifies or switches the user plane. It performs operations such as announcement generation, tone generation, echo cancellation, modem handling for data calls and CODEC (transcoder) handling for speech calls.

A signaling gateway (GW) performs bearer conversion of signaling messages. In UMTS with an ATM core network and ISDN network interworking a conversion from ATM/AAL5 to MTP is done in the signaling gateway. The signaling GW relays the N-ISUP signaling and exchanges the lower transport layer which is carrying the signaling. Therefore the signaling GW is always collocated with e. g. a GMSC or TSC server.

The backbone network transfers the user plane and the control signaling and can, e.g., be based on STM, ATM or IP. The media gateway is the edge node of the backbone network.

The following mnemonics, in addition to others which are well known, are used herein:

AAL2	ATM Adaptation Layer Type 2
ACM	Address Complete Message
ATM	Asynchronous Transfer Mode
BICC	Bearer Independent Call Control
CCD	Conference Call Device
CIC	Circuit Identity Code
CFB	Call Forwarding Busy

CFNREA	Call Forwarding Not REAchable
CFNRY	Call Forwarding No ReplY
CFU	Call Forwarding Unconditional
CM	Connection Management
CPG	Call ProceedinG Message
CW	Call Waiting Supplementary Service
DCP	Device Control Protocol, e. g. H.GCP
DPC	Destination Point Code
DTAP	Direct Transfer Application Part
GMSC	Gateway MSC
HLR	Home Location Register
HOLD	Call Hold Supplementary Service
IAM	Initial Address Message
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part
MAP	Mobile Application Part
MGW	Media Gateway
MSC	Mobile Services Switching Center
MPTY	MultiParTY Supplementary Service
OPC	Originating Point Code
PC	Point Code
P	logical Point
RANAP	Radio Access Network Application Part
RNC	Radio Network Controller

SigGW	Signaling GateWay
STM	Synchronous Transfer Mode
TSC	Transit Switching Center
UE	User Equipment (mobile)

In the new network architecture described herein, N-ISDN is used for call control, while STM, AAL2 or IP are used for bearer control and usage of the user plane.

The generation of control tones are omitted in this description and shall be handled in other known manners.

The media gateway address can be transported on BICC ISDN for e. g., as a sub-layer transport address. To find the transit switching centre and/or the media gateway address, some IN service, the routing analysis or the B-number analysis, are used. The transit switching centre is then chosen for an outgoing call to the ISDN. The media gateway is chosen based on capabilities required for handling the call, e. g. which devices such as CODECs, coding, compression, framing scheme, announcement machines, tone senders, or modems are required. In the examples, for simplification, only the B-number analysis is mentioned. The selection depends mainly on the destination. Depending on the destination a group of media gateways with different capabilities can be found. Then a media gateway with the needed capabilities, e. g., CCDs, modem support, Internet connectivity is chosen.

All resources which have been reserved by a server have to be released by that server. For simplifying the message flows the release of resources in the media gateway is omitted from this description.

In the examples, a one-to-one relation is assumed between the first control node GMSC/TSC server inside the core network (CN) and the first media gateway inside the CN.

To be able to receive incoming calls over different media gateways, but with the control signaling (IAM) to the same gateway mobile services switching centre, the gateway mobile services switching centre needs to have one point code per media gateway, where the ISDN user plane can terminate. Out of the DPC, to which the IAM was sent, the gateway mobile services switching centre can derive the media gateway to which the ISDN user plane was set up.

To allow that a transit switching centre controls more than one media gateway for outgoing (incoming) traffic the transit switching centre needs one point code per controlled media gateway. For a chosen media gateway the transit switching centre has to use a certain OPC. Depending on the chosen OPC the transit switch can distinguish the ISDN user planes received from different media gateways.

Another alternative solution to receive or send user plane to different media gateways is that different signaling routes are used between servers, if the user plane is routed via different media gateways.

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A third alternative to receive or send user plane to different media gateways from/to a transit switch and control signaling from/to one server is that different CICs are used for different media gateways, if the user plane is routed via different media gateways.

The concept of identifying the originating media gateway by OPC used in the IAM message instead of transporting the media gateway address in the IAM message, is also possible through the whole CN, but it requires, for a network of m media gateways, m different point codes in each of the control servers, which can control the media gateways.

Another alternative solution to transfer the knowledge of an media gateway from one server to the other is to use different routes for signaling, if the user plane was routed to different media gateways. If a transit switching centre can receive calls from m media gateways, then m different signaling routes towards the radio network controller are required.

In the following description of the various drawings, various signal names are used. Some of these signals are conventional in nature. The DTAP messages are defined in GSM 04.08 V8.0.0 and UMTS 24.08 V3.0.0. The RANAP messages are defined in UMTS 25.413 V1.0.2. The MAP messages are defined in GSM 09.02 V6.3.0 and UMTS 29.002 V3.3.2. The AAL2 messages are used for bearer control in accordance with the invention. The DCP messages, which are particularly described below, are used for communications between control nodes and the media gateways in connection with resource requests and assignments. The ISDN messages are used for signaling between network control nodes and external ISDN networks.

Figure 1 shows a call from user equipment to user equipment, with a media gateway address being transported in a backward direction. Here, even though the call is initiated at a first control node mobile services switching centre MSC1, the media gateway MGW1 is chosen in a further control node mobile services switching centre MSC2. Then the media gateway MGW1 address and a logical point are

transferred in the backward direction with ISUP ACM/CPG/APM or some new message to the originating mobile services switching centre MSC1. The mobile services switching centre MSC2 can negotiate a CODEC with user equipment B and passes this CODEC type on to user equipment A. By this no CODEC is needed in media gateway MGW1. This leads to better speech quality by avoiding transcoding. Also less transmission capacity is needed for transferring coded speech and the CODEC hardware is saved. The mobile services switching centre MSC1 then commands RNC1 to setup the user plane connection towards media gateway MGW1 and commands media gateway MGW1 to through connect. Then mobile services switching centre MSC2 commands RNC2 to set up the user plane connection towards media gateway MGW1. Only one media gateway is needed in this traffic case for switching.

The following signals are used in the traffic example of Figure 1.

1. DTAP, CM service request
2. DTAP, Setup (CODEC (x, y, z))
3. DTAP, Call Proceeding
4. ISDN, IAM (OPC, DPC, CIC, CODEC (x, y))

   Call setup is requested from the originating mobile services switching centre MSC1 for CODEC (x, y) used.
5. MAP, SendRouting Information request

   The gateway mobile services switching centre GMSC1 interrogates the home location register HLR for routing information.
6. MAP, SendRouting Information response

The gateway mobile services switching centre GMSC1 receives the forwarding to number and an indication, if a notification shall be given to the calling party.

7. ISDN, Address Complete Message (ACM)

The ACM message is sent from the gateway mobile services switching centre GMSC1 to the mobile services switching centre MSC1.

8. ISDN, Initial Address Message IAM (OPC, DPC, CIC)

The IAM message is sent from the gateway mobile services switching centre GMSC1 to the mobile services switching centre MSC2.

9. RANAP, Paging

10. DTAP, Paging Response

11. DTAP, Setup (CODEC (x, y))

12. DTAP, Call confirmed (CODEC (x))

13. DCP, resource request (MGW1, CIC)

The mobile services switching centre MSC2 chooses media gateway MGW1 and requests resources.

14. DCP, resource response (Pi1, Pv11)

An incoming point Pi2 is returned from the media gateway MGW1.

15. DCP, Through connect (Pv11, Pi1)

The mobile services switching centre MSC2 commands the media gateway MGW1 to backward through connect the virtual point Pv11 and the incoming point Pi1. In N-ISUP the originating switch does the backward through connection instead.

16. DCP, resource request (MGW1, Pv11)

Resources are requested for the outgoing traffic.

17. DCP, resource response (Po1)

An outgoing point Po1 is returned from the media gateway MGW1.

18. RANAP, Assignment Request

19. AAL2, Establish Request

20. AAL2, Establish confirm

21. RANAP, Assignment Response

22. ISUP, new APM (MGW1, Pi1)

23. ISUP, new APM (MGW1, Pi1)

24. DTAP, Progress Message (CODEC (x))

25. RANAP, Assignment Request

Assignment to media gateway MGW1.

26. AAL2, Establish Request

27. AAL2, Establish confirm

28. RANAP, Assignment Response

29. DTAP, Alert

30. ISDN, Address Complete Message ACM

31. ISDN, Call Proceeding CPG

32. DTAP, Connect

33. DTAP, Connect ack

34. DCP, Through connect (Pv11, Po1)

The mobile services switching centre MSC2 commands the media gateway MGW1 to through connect the virtual point Pv11 and the outgoing point Po1.

35. DCP, Through connect (Pv11, Pi1)

The mobile services switching centre MSC2 commands the media gateway MGW1 to through connect the incoming point Pi1 and the virtual point Pv11 in both directions.

36. ISUP, Answer Message ANM

37. ISUP, Answer Message ANM

38. DTAP, Connect

39. DTAP, Connect ACK

Figure 2 shows a call to user equipment originating outside of the network, with an media gateway address being transported in a backward direction. Here a subscriber B is calling a served user equipment A. It is assumed that the external N-ISUP does not support the new ISUP backwards message APM.

1. ISDN, Initial Address Message IAM (OPC, DPC, CIC)

   Call setup is requested from an external ISDN network for a mobile terminated call attempt. In this example the GMSC1/TSC and the Signaling Gateway SigGw1 are collocated.

2. DCP, resource request (MGW1, CICi1)

   Resources are requested from the media gateway MGW1 for the call identified by its CIC, which were chosen by the transit switch 1 of the ISDN network.

3. DCP, resource response (Pi1, Pv11)

   An incoming point Pi1 and a virtual point Pv11 are returned from the media gateway MGW1.

4. MAP, SendRouting Information request

The gateway mobile services switching centre GMSC1 interrogates the home location register HLR for routing information.

5. MAP, SendRouting Information response

The gateway mobile services switching centre GMSC1 receives the mobile services switching centre MSC address.

6. ISDN, Address Complete Message ACM

The ACM message is sent from the gateway mobile services switching centre GMSC1 to the transit switch 1.

7. Optional DCP, Through connect (Pi1, Pv11)

The gateway mobile services switching centre GMSC1 commands the media gateway MGW1 to through connect the incoming point Pi1 and the virtual point Pv11. Optionally, the whole media gateway MGW1 connection can be through connected with one DCP, Through connect (Pi1, Po1) message.

8. ISDN, IAM (OPC, DPC, CIC, CODEC (x, y))

The IAM message is sent from the gateway mobile services switching centre GMSC1 to the mobile services switching centre MSC. The mobile services switching centre MSC is selecting the media gateway MGW2.

9. RANAP, Paging

10. DTAP, Paging Response

11. DTAP, Setup (CODEC (x, y))

12. DTAP, Call confirmed (CODEC (x))

13. DCP, resource request (MGW2)

Resources are requested from the media gateway MGW2 for the call identified by its CIC.

14. DCP, resource response (Pi1, Pv21)

An incoming point Pi2 and a virtual point Pv21 are returned from the media gateway MGW2.

15. ISUP, new APM (MGW2, Pi2, CODEC x)

16. DCP, Setup connection (MGW1, MGW2, Pv11, Pi2)

The gateway mobile services switching centre GMSC1 requests resources for an outgoing call identified by its virtual CIC and commands the media gateway MGW1 to set up a connection towards Pi2 in media gateway MGW2.

17. AAL2, Establish Request

18. AAL2, Establish confirm

19. DCP, Setup connection response (Po1)

The media gateway MGW1 signals back that the outgoing connection has been set up successfully and returns an outgoing point Po1.

20. DCP, Through connect (Po1, Pv11)

The gateway mobile services switching centre GMSC1 commands the media gateway MGW1 to through connect the outgoing point Po1 and the virtual point Pv11. Optionally, the whole media gateway MGW1 connection can be through connected with one DCP, Through connect (Pi1, Po1) message.

21. Optional DCP, Through connect (Pi2, Pv21)

The mobile services switching centre MSC commands the media gateway MGW2 to through connect the incoming point Pi2 and the virtual point Pv21.

22. DCP, resource request (MGW2, Pv21)

Resources are requested for the outgoing traffic.

23. DCP, resource response (Po2)

An incoming point Po2 is returned from the media gateway MGW2.

24. RANAP, Assignment Request

25. AAL2, Establish Request

26. AAL2, Establish confirm

27. RANAP, Assignment Response

28. DTAP, Alert

29. ISDN, Address Complete Message ACM

30. ISDN, Call Proceeding CPG

31. DTAP, Connect

32. DTAP, Connect ack

33. DCP, Through connect (Po2, Pv21)

The mobile services switching centre MSC commands the media gateway MGW2 to through connect the outgoing point Po2 and the virtual point Pv21. Optionally, the whole media gateway MGW 2 connection can be through connected with one DCP, Through connect (Pi2, Po2) message.

34. ISUP, Answer Message ANM

35. ISUP, Answer Message ANM

Figure 3 shows a roaming call to user equipment in own PLMN, with an media gateway address being transported in a backward direction.

It is assumed that the external N-ISUP does not support the new ISUP backwards message APM. The linking of transcoders is an option. The speech can be transferred without linking of transcoders as non-compressed speech.

1. ISDN, Initial Address Message IAM (OPC, DPC, CIC)

   Call setup is requested from an external ISDN network for a mobile terminated call attempt. In this example the gateway mobile services switching centre/transit switching centre GMSC/TSC1 and the Signaling Gateway SigGw1 are collocated.

2. MAP, SendRouting Information request

   The gateway mobile services switching centre GMSC/TSC1 interrogates the home location register HLR for routing information.

3. MAP, SendRouting Information response

   The gateway mobile services switching centre GMSC/TSC1 receives the roaming number of an mobile services switching centre outside the PLMN. The roaming number received from home location register HLR is analysed and a transit switching centre is received from the B-number analyse.

4. DCP, resource request (MGW1, CIC)

   Resources are requested from the media gateway MGW1 for the call identified by its CIC, which were chosen by the transit switch 1 of the ISDN network.

5. DCP, resource response (Pi1, Pv11)

An incoming point Pi1 and a virtual point Pv11 are returned from the media gateway MGW1.

6. ISDN, Address Complete Message ACM

The ACM message is sent from the gateway mobile services switching centre GMSC/TSC1 to the transit switch 1.

7. DCP, Through connect (Pi1, Pv11)

The gateway mobile services switching centre GMSC/TSC1 commands the media gateway MGW1 to through connect the incoming point Pi1 and the virtual point Pv11. Optionally, the whole media gateway MGW1 connection can be through connected with one DCP, Through connect (Pi1, Po1) message.

8. ISDN, IAM (OPC, DPC, CIC, optional CODEC (x, y))

The IAM message is sent from the gateway mobile services switching centre GMSC/TSC1 to the transit switching centre TSC2. The transit switching centre TSC2 is selecting the media gateway MGW2.

9. DCP, resource request (MGW2)

Resources are requested by the transit switching centre TSC2 from the media gateway MGW2 for the call identified by its CIC.

10. DCP, resource response (Pi2, Pv21)

An incoming point Pi2 and a virtual point Pv21 are returned from the media gateway MGW2.

11. ISUP, new APM (MGW2, Pi2, optional CODEC (x))

12. DCP, Setup connection (MGW1, MGW2, PV11, Pi2)

The gateway mobile services switching centre GMSC/TSC1 requests resources for an outgoing call identified by its virtual CIC and

commands the media gateway MGW1 to set up a connection towards Pi2 in media gateway MGW2.

13. AAL2, Establish Request

14. AAL2, Establish confirm

15. DCP, Setup connection response (Po1)

The media gateway MGW1 signals back that the outgoing connection has been set up successfully and returns an outgoing point Po1.

16. DCP, Through connect (Po1, Pv11)

The gateway mobile services switching centre GMSC/TSC1 commands the media gateway MGW1 to through connect the outgoing point Po1 and the virtual point Pv11. Optionally, CODEC x is linked in.

17. DCP, Through connect (Pi2, Pv21)

The transit switching centre TSC2 commands the media gateway MGW2 to through connect the incoming point Pi2 and the virtual point Pv21.

18. DCP, Setup connection (MGW2, Pv21)

The transit switching centre TSC2 requests resources for an outgoing call identified by its virtual CIC and commands the media gateway MGW2 to set up a connection towards the transit switch 2.

19. DCP, Setup connection response (Po2, CIC)

The media gateway MGW2 signals back that the outgoing connection has been set up successfully and returns an outgoing point Po2.

20. DCP, Through connect (Po2, Pv21)

The transit switching centre TSC2 commands the media gateway MGW2 to through connect the outgoing point Po2 and the virtual point Pv21.

21. ISDN, Initial Address Message IAM (OPC, DPC, CIC)

The IAM message is sent from the transit switching centre TSC2 to the transit switch 2.

22. ISDN, Address Complete Message ACM

23. ISDN, Call Proceeding CPG

24. ISDN, Call Proceeding CPG

25. ISDN, Answer Message ANM

26. ISDN, Answer Message ANM

The ANM message is passed on by the transit switching centre TSC2.

27. ISDN, Answer ANM

The ANM message is passed on by the gateway mobile services switching centre GMSC/TSC1.

Figure 4 shows a call forwarding example in gateway mobile services switching centre GMSC/TSC1 to an ISDN subscriber identified by an ISDN no., with an media gateway address being transported in a backward direction. For CFNREA in mobile services switching centre the same handling applies as for CFNREA in gateway mobile services switching centre GMSC/TSC1. Therefore only the signaling for CFNREA in GMSC are described below.

It is assumed that the external N-ISUP does not support the new ISUP backwards message APM. The inlinking of transcoders is an option. The speech can be transferred without inlinking of transcoders as non-compressed speech.

1. ISDN, Initial Address Message IAM (OPC, DPC, CIC)

Call setup is requested from an external ISDN network for a mobile terminated call attempt. In this example the gateway mobile services switching centre/transit switching centre GMSC/TSC1 and the Signaling Gateway SigGw1 are collocated.

2. MAP, SendRouting Information request

The gateway mobile services switching centre GMSC/TSC1 interrogates the home location register HLR for routing information.

3. MAP, SendRouting Information response

The gateway mobile services switching centre GMSC/TSC1 receives the forwarding to number and an indication, if a notification shall be given to the calling party. The forwarded-to number received from home location register HLR is analyzed and a transit switching centre TSC2 address is received from the B-number analysis.

4. DCP, resource request (MGW1, CIC)

Resources are requested from the media gateway MGW1 for the incoming call identified by its CIC, which were chosen by the transit switch 1 of the ISDN network.

5. DCP, resource response (Pi1, Pv11)

An incoming point Pi1 and a virtual point Pv11 are returned from the media gateway MGW1.

6. ISDN, Address Complete Message ACM

The ACM message is sent from the gateway mobile services switching centre GMSC/TSC1 to the transit switch 1. An outband notification can be included in the ACM message. This saves

signaling, in and out linking of announcement machine and user plane transmission.

7. Optional DCP, Connect announcement machine (Pi1)

Optionally, the announcement machine is connected, if inband notification is required.

8. Optional DCP, Disconnect announcement machine (Pi1)

After the announcement the announcement machine is disconnected.

9. DCP, Through connect (Pi1, Pv11)

The gateway mobile services switching centre GMSC/TSC1 commands the media gateway MGW1 to through connect the incoming point Pi1 and the virtual point Pv11.

10. ISDN, IAM (OPC, DPC, CIC, optional CODEC (x, y))

The IAM message is sent from the gateway mobile services switching centre GMSC/TSC1 to the transit switching centre TSC2. The transit switching centre TSC2 selects the media gateway MGW2 and optional CODEC x.

11. DCP, resource request (MGW2)

Resources are requested from the media gateway MGW2 for the call identified by its CIC.

12. DCP, resource response (Pi2, Pv21)

An incoming point Pi2 and a virtual point Pv21 are returned from the media gateway MGW2.

13. ISUP, new APM (MGW2, Pi2, optional CODEC (x))

14. DCP, Setup connection (MGW1, MGW2, Pv11, Pi2)

The GMSC/TSC1 requests resources for an outgoing call identified by its virtual CIC and commands the media gateway MGW1 to set up a connection toward Pi2 in media gateway MGW2.

15. AAL2, Establish Request

16. AAL2, Establish confirm

17. DCP, Setup connection response (Po1)

The media gateway MGW1 signals back that the outgoing connection has been set up successfully and returns an outgoing point Po1.

18. Through connect (Po1, Pv11)

The gateway mobile services switching centre GMSC/TSC1 commands the media gateway MGW1 to through connect the outgoing point Po1 and the virtual point Pv11. Optionally, CODEC x is linked in.

19. DCP, Through connect (Pi2, Pv21)

The transit switching centre TSC2 commands the media gateway MGW2 to through connect the incoming point Pi2 and the virtual point Pv21.

20. DCP, Setup connection (MGW2, Pv21)

The transit switching centre TSC2 requests resources for an outgoing call identified by its virtual CIC and commands the media gateway MGW2 to set up a connection towards the transit switch 2.

21. DCP, Setup connection response (Po2, CIC)

The media gateway MGW2 signals back that the outgoing connection has been set up successfully and returns an outgoing point Po2.

22. DCP, Through connect (Po2, Pv21)

The transit switching centre TSC2 commands the media gateway MGW2 to through connect the outgoing point Po2 and the virtual point Pv21. Optionally, CODEC x is linked in.

23. ISDN, Initial Address Message IAM (OPC, DPC, CIC)

The IAM message is sent from the transit switching centre TSC2 to the transit switch 2.

24. ISDN, Address Complete Message ACM

25. ISDN, Call Proceeding CPG

26. ISDN, Call Proceeding CPG

27. ISDN, Answer Message ANM

28. ISDN, Answer Message ANM

The ANM message is passed on by the transit switching centre TSC2.

29. ISDN, Answer ANM

The ANM message is passed on by the GMSC/TSC1.

Figure 5 shows a call from user equipment with Call forwarding in GMSC to a subscriber identified by a user equipment no., with an media gateway address being transported in a backward direction. In this example, a user equipment A calls a user equipment B. As the user equipment B is not reachable, a CFNREA with announcement is invoked in gateway mobile services switching centre GMSC1. The forwarding is done to a third user equipment C. Therefore the call is routed towards gateway mobile services switching centre GMSC2, which then contacts mobile services switching centre MSC2, where user equipment C is located. Mobile services switching centre MSC2 then selects an media gateway MGW2, which it passes on in backward direction to mobile services switching centre MSC1. Mobile

services switching centre MSC1 commands then RNC1 to set up the connection towards media gateway MGW2.

For subsequent forwarding to user equipment in GMSC, instead of gateway mobile services switching centre GMSC2, gateway mobile services switching centre GMSC2, gateway mobile services switching centre GMSC3, etc. have to be included. As the mobile services switching centre MSC1 passes the CODEC list to the mobile services switching centre MSC2, the mobile services switching centre MSC2 negotiates with the user equipment 2 to choose a CODEC from the list and report it in backward direction. The user equipment 1 has then to use this CODEC and no further coding is required in the network. In this example the announcement machine uses CODEC x and the user equipment C uses CODEC y.

1. DTAP, CM service request
2. DTAP, Setup (CODEC (x, y))
3. DTAP, Call Proceeding
4. ISDN, IAM (OPC, DPC, CIC, CODEC (x, y))

   Call setup is requested from the originating mobile services switching centre MSC1.
5. MAP, SendRouting Information request

   The gateway mobile services switching centre GMSC1 interrogates the home location register HLR for routing information.
6. MAP, SendRouting Information response

   The gateway mobile services switching centre GMSC1 receives the forwarding to number and an indication, if a notification shall be given to the calling party.

7. DCP, resource request (MGW1, CIC)

Resources are requested from the media gateway MGW1 for the call identified by its CIC.

8. DCP, resource response (Pi1, Pv11)

An incoming point Pi1 and a virtual point Pv11 are returned from the media gateway MGW1.

9. ISUP, new APM (MGW1, Pi1, CODEC x)

As an announcement is needed, gateway mobile services switching centre GMSC1 selects media gateway MGW1 and CODEC x.

10. DTAP, Progress (CODEC x)

11. RANAP, Assignment Request (MGW1, Pi1)

12. AAL2, Establish Request

13. AAL2, Establish Confirm

14. RANAP, Assignment Response

15. ISDN, Address Complete Message ACM

The ACM message is sent from the gateway mobile services switching centre GMSC1 to the mobile services switching centre MSC1. An outband notification can be included in the ACM message. This saves signaling, in and out linking of announcement machine and user plane transmission.

16. DCP, Connect announcement machine (Pi1)

The announcement machine is connected, as inband notification is required.

17. DCP, Disconnect announcement machine (Pi1)

After the announcement the announcement machine is disconnected.

18. ISDN, IAM (OPC, DPC, CIC, CODEC (x, y))

The IAM message is sent from the gateway mobile services switching centre GMSC1 to the gateway mobile services switching centre GMSC2.

19. MAP, SendRouting Information request

The gateway mobile services switching centre GMSC2 interrogates the home location register HLR for routing information.

20. MAP, SendRouting Information response

The gateway mobile services switching centre GMSC2 receives the MSC address from home location register HLR.

21. ISDN, IAM (OPC, DPC, CIC, CODEC (x, y))

The IAM message is sent from the gateway mobile services switching centre GMSC2 to the mobile services switching centre MSC2. mobile services switching centre MSC2 selects media gateway MGW2.

22. RANAP, Paging

23. DTAP, Paging Response

24. DTAP, Setup (CODEC (x, y))

25. DTAP, Call confirmed (CODEC y)

26. DCP, resource request (MGW2, CIC)

Resources are requested from the media gateway MGW2 for the call identified by its CIC.

27. DCP, resource response (Pi2, Pv21)

An incoming point Pi2 is returned from the media gateway MGW2.

28. DCP, Through connect (Pv21, Pi2)

The mobile services switching centre MSC2 commands the media gateway MGW2 to backward through connect the virtual point Pv21 and the incoming point Pi2. In N-ISUP the originating switch does the backward through connection instead.

29. DCP, resource request (MGW1, Pv21)

Resources are requested for the outgoing traffic.

30. DCP, resource response (Po2)

An outgoing point Pi2 is returned from the media gateway MGW2.

31. RANAP, Assignment Request

32. AAL2, Establish Request

33. AAL2, Establish confirm

34. RANAP, Assignment Response

35. ISUP, new APM (MGW2, Pi2, CODEC y)

36. ISUP, new APM (MGW2, Pi2, CODEC y)

37. ISUP, new APM (MGW2, Pi2, CODEC y)

38. RANAP, Assignment Request

Subsequent assignment to media gateway MGW2. This will also release the connection from RNC1 to media gateway MGW1.

39. DTAP, Progress (CODEC x)

40. AAL2, Establish Request

41. AAL2, Establish confirm

42. RANAP, Assignment Response

43. DTAP, Alert

44. ISDN, Address Complete Message ACM

45. ISDN, Call Proceeding CPG

46. ISDN, Call Proceeding CPG

47. DTAP, Alerting

48. DTAP, Connect

49. DTAP, Connect ack

50. DCP, Through connect (Pv21, Pi2)

The mobile services switching centre MSC2 commands the media gateway MGW2 to through connect the incoming point Pi2 and the virtual point Pv21 in both directions.

51. DCP, Through connect (Pv21, Po2)

The mobile services switching centre MSC2 commands the media gateway MGW2 to through connect the virtual point Pv21 and the incoming point Po2. Optionally, the media gateway MGW2 connection can be through connected with one DCP, Through connect (Pi2, Po2) message.

52. ISUP, Address Complete Message ANM

53. ISUP, Address Complete Message ANM

54. ISUP, Address Complete Message ANM

55. DTAP, Connect

56. DTAP, Connect ACK

Figure 6 shows call waiting and accepting the waiting call in one media gateway, with an media gateway address being transported in a backward direction.

Here a subscriber A is calling a served user equipment B, who has the supplementary services CW and HOLD. After the call from subscriber A to user

equipment B is active another terminating call from a subscriber C over media gateway MGW2 to user equipment B is received. user equipment B accepts the waiting call from C and therefore has to put the call from A on hold. The user plane for the call from subscriber A to user equipment B is routed from media gateway MGW1 to the media gateway MGW2 and the user plane of the call from subscriber C to user equipment B is routed from media gateway MGW3 to media gateway MGW2 as media gateway MGW2 offers CCDs. After user equipment B accepts the waiting call, the mobile services switching centre MSC commands media gateway MGW2 to switch from the former active call to the waiting call. The active call becomes then the held call. It is assumed that both the active and the waiting call use the same service, e. g., speech with the same CODEC, so that the AAL2 connection between radio network controller RNC and media gateway MGW1 can be reused. This allows fast switches between the active and the held call, and if a multiparty is required later on, only a conference call device has to be linked in the media gateway MGW2.

This mechanism requires for this traffic case three media gateways instead of two. If the subscriber C is a mobile subscriber in this network then only two media gateways are needed, media gateway MGW1 and media gateway MGW2.

It is assumed that the external N-ISUP does not support the new ISUP backwards message APM. If a multiparty is required later on, a conference call device has to be linked in the media gateway MGW2.

As currently CCDs only support PCM coding, on the incoming legs the same CODEC as used in the respective media gateway has to be used, e. g., CODEC x on each call leg. Another solution is to send an ISUP message, e. g.,

APM to each gateway mobile services switching centre GMSC/TSC, to command it to link out the CODEC.

1. ISDN, Initial Address Message IAM (OPC, DPC, CIC)

   Call setup is requested from an external ISDN network for a mobile terminated call attempt. In this example the gateway mobile services switching centre GMSC1/TSC1 and the Signaling Gateway 1 are collocated.

2. DCP, resource request (MGW1, CIC)

   Resources are requested from the media gateway MGW1 for the incoming call identified by its CIC, which were chosen by the transit switch 1 of the ISDN network.

3. DCP, resource response (Pi1, Pv11)

   An incoming point Pi1 and a virtual point Pv11 are returned from the media gateway MGW1.

4. MAP, SendRouting Information request

   The gateway mobile services switching centre GMSC1 interrogates the home location register HLR for routing information.

5. MAP, SendRouting Information response

   The gateway mobile services switching centre GMSC1 receives the mobile services switching centre MSC address.

6. ISDN, Address Complete Message ACM

   The ACM message is sent from the gateway mobile services switching centre GMSC1/TSC1 to the transit switch 1.

7. DCP, Through connect (Pi1, Pv11)

The gateway mobile services switching centre GMSC1/TSC1 commands the media gateway MGW1 to through connect the incoming point Pi1 and the virtual point Pv11.

8. ISDN, IAM (OPC, DPC, CIC, CODEC (x, y))

The IAM message is sent from the gateway mobile services switching centre GMSC1/TSC1 to the mobile services switching centre MSC. The mobile services switching centre MSC selects the media gateway MGW2.

9. RANAP, Paging

10. DTAP, Paging Response

11. DTAP, Setup (CODEC x, y))

12. DTAP, Call confirmed (CODEC x)

13. DCP, resource request (MGW2)

Resources are requested for the incoming call identified by its CIC.

14. DCP, resource response (Pi2, Pv21)

An incoming point Pi1 and a virtual point Pv21 are returned from the media gateway MGW2.

15. ISUP, new APM (MGW2, Pi2, CODEC (x))

16. DCP, Setup connection (MGW1, MGW2, Pv11, Pi2)

The gateway mobile services switching centre GMSC1/TSC1 requests resources for an outgoing call identified by its virtual CIC and commands the media gateway MGW1 to set up a connection towards Pi2 in media gateway MGW2.

17. AAL2, Establish Request

18. AAL2, Establish confirm

19. DCP, Setup connection response (Po1)

The media gateway MGW1 signals back that the outgoing connection has been set up successfully and returns an outgoing point Po1.

20. DCP, Through connect (Po1, Pv11)

The gateway mobile services switching centre GMSC1/TSC1 commands the media gateway MGW1 to through connect the outgoing point Po1 and the virtual point Pv11.

21. DCP, Through connect (Pi2, Pv21)

The mobile services switching centre MSC commands the media gateway MGW2 to through connect the incoming point Pi2 and the virtual point Pv21.

22. DCP, resource request (MGW2, Pv21)

Resources are requested for the outgoing traffic.

23. DCP, resource response (Po2)

An outgoing point Po2 is returned from the media gateway MGW2.

24. RANAP, Assignment Request

25. AAL2, Establish Request

26. AAL2, Establish confirm

27. RANAP, Assignment Response

28. DTAP, Alert

29. ISDN, Address Complete Message ACM

30. ISDN, Call Proceeding CPG

31. DTAP, Connect

32. DTAP, Connect ack

33. DCP, Through connect (Po2, Pv21)

The mobile services switching centre MSC commands the media gateway MGW2 to through connect the outgoing point Po2 and the virtual point Pv21.

34. ISUP, Answer Message ANM

35. ISUP, Answer Message ANM

36. ISDN, Initial Address Message IAM (OPC, DPC, CIC)

Call setup is requested from an external ISDN network for a mobile terminated call attempt. In this example the gateway mobile services switching centre GMSC2/TSC2 and the Signaling Gateway 2 are collocated.

37. DCP, resource request (MGW3, CIC)

Resources are requested from the media gateway MGW3 for the incoming call identified by its CIC, which were chosen by the transit switch 2 of the ISDN network.

38. DCP, resource response (Pi3, Pv31)

An incoming point Pi3 and a virtual pont Pv31 are returned from the media gateway MGW3.

39. MAP, SendRouting Information request

The gateway mobile services switching centre GMSC2 interrogates the home location register HLR for routing information.

40. MAP, SendRouting Information

The gateway mobile services switching centre GMSC2 receives the mobile services switching centre MSC address.

41. ISDN, Address Complete Message ACM

The ACM message is sent from the gateway mobile services switching centre GMSC2/TSC2 to the transit switch 2.

42. DCP, Through connect (Pi3, Pv31)

The gateway mobile services switching centre GMSC2/TSC2 commands the media gateway MGW3 to through connect the incoming point Pi3 and the virtual point Pv31.

43. ISDN, Initial Address Message IAM (OPC, DPC, CIC)

The IAM message is sent from the gateway mobile services switching centre GMSC2/TSC2 to the mobile services switching centre MSC, which is controlling the media gateway MGW2.

44. DTAP, Setup (CODEC (x))

45. DTAP, Call confirmed (CODEC (x)

46. DCP, resource request (MGW2)

Resources are requested for the incoming call identified by its CIC.

47. DCP, resource response (Pi22, Pv22)

An incoming point Pi2 and a virtual point Pv21 are returned from the media gateway MGW2.

48. DTAP, Alert

49. ISDN, Address Complete Message ACM

50. ISDN, Call Proceeding CPG

51. DTAP, HOLD (B)

52. DTAP, HOLD ACK

53. ISUP, Call Proceeding Message CPG (B held)

54. ISUP, Call Proceeding Message CPG (B held)

55. ISUP, new APM (MGW2, Pi22, CODEC (x))

56. DCP, Setup connection (MGW3, MGW2, Pv31, Pi22)

The gateway mobile services switching centre GMSC2/TSC2 requests resources for an outgoing call identified by its virtual CIC and commands the media gateway MGW3 to set up a connection towards Pi22 in media gateway MGW2.

57. AAL2, Establish Request

58. AAL2, Establish confirm

59. DCP, Setup connection response (Po3)

The media gateway MGW3 signals back that the outgoing connection has been set up successfully and returns an outgoing point Po3.

60. DCP, Through connect (Po3, Pv31)

The gateway mobile services switching centre GMSC2/TSC2 commands the media gateway MGW3 to through connect the outgoing point Po3 and the virtual point Pv31.

61. DCP, Through connect (Pi22, Pv22)

The mobile services switching centre MSC commands the media gateway MGW2 to through connect the incoming point Pi22 and the virtual point Pv22.

62. DCP, Disconnect (Po2, Pv21)

63. DTAP, Connect

64. DTAP, Connect ack

65. DCP, Through connect (Pv22, Po2)

The mobile services switching centre MSC commands the media gateway MGW2 to through connect the virtual point Pv22 and the outgoing point Po2. This connects the existing user plane between

radio network controller RNC and media gateway MGW2 with the user plane of subscriber C.

66. ISUP, Answer Message ANM

67. ISUP, Answer Message ANM

Figure 7 shows a roaming user equipment call leg in home PLMN and roaming user equipment call leg in visitor PLMN, for media gateway transported in the backward direction.

This example shows the interworking between a first transit network, where the terminating call is received, an ATM based home PLMN, where the IAM/APM mechanism is implemented, an STM based ISUP network, where IAM/APM mechanism is implemented and a terminated visited PLMN, where IAM/APM mechanism is implemented.

For the visited PLMN the detailed signal description can be found in the above description relating to Figure 2. Similarly, for the home PLMN on the right side the detailed description can be found in the above description relating to Figure 3.

Here a served user equipment B receives a call from a subscriber A over the transit switch 1. The IAM is received with no CODEC list and transit switching centre TSC1 adds a CODEC list to the IAM and forwards the IAM to the gateway mobile services switching centre GMSC/TSC1, which interrogates the home location register HLR, and gets an mobile services switching centre MSC address. The mobile services switching centre MSC belongs to another PLMN and can be only be reached over an STM network. Therefore the gateway mobile services switching centre GMSC/TSC1 forwards the IAM with the CODEC list to a transit switching centre TSC2, which is controlling the media gateway MGW2. The transit

switching centre TSC2 is interworking with a transit STM network, which consists of transit switch 2 and transit switch 3. This transit network forwards the received IAM from transit switching centre TSC2 with the CODEC list to the transit switching centre TSC3. transit switching centre TSC3 can reduce this list, if it does not support all CODEC types. transit switching centre TSC3 forwards the IAM with the CODEC list to the MSC, which sends the list in the set up message to the user equipment and the user equipment replies the chosen CODEC in the call confirmed message. The mobile services switching centre MSC chooses then media gateway MGW4 and gives media gateway MGW4 address, a logical incoming point and the chosen CODEC type back in the APM back to transit switching centre TSC3. Transit switching centre TSC3 sets up the user plane between media gateway MGW3 and media gateway MGW4 and links in the chosen CODEC. Transit switching centre TSC3 sends back the chosen CODEC in the APM message to the transit switching centre TSC2. Transit switching centre TSC2 links in the chosen CODEC in media gateway MGW2 and signals in the APM the media gateway MGW2 address, a logical incoming point and the chosen CODEC. Gateway mobile services switching centre GMSC/TSC1 links in the CODEC and sets up the user plane from media gateway MGW1 to media gateway MGW2 and indicates that the user plane has been set up to the transit switch 1.

As all CODECs are of the same type the CODEC in media gateway MGW2 and the CODEC in media gateway MGW3 can go to the TFO mode. In TFO mode the CODEC is bypassed and compressed CODEC speech can be transferred over the PCM network in between. By this the speech quality improves as a transcoding can be omitted.

The above described examples illustrate the new approach to separation of call control and bearer control for implementation of GSM and UMTS core networks, with transport layer address and logical points being transported in the backward direction.

5

CLAIMS

1. A method for setting up a call in a wireless communication network with a separation of call control and bearer control, the call control being performed by control nodes and the bearer control being performed by at least one media gateway, comprising:

receiving a call setup request at a first control node;

forwarding the call setup request from the first control node to a succeeding control node and, if the call setup request is received from a control node of a further network, selecting a media gateway and sending the media gateway address to the succeeding control node;

receiving the call setup request in the succeeding control node; and

selecting a media gateway at the succeeding control node and sending the media gateway address in a backward direction to preceding control nodes if at least one of a user plane modification is necessary and a media gateway is needed for switching.

2. A method according to claim 1, wherein after receiving the call setup request, the succeeding control node becomes a control node in charge, and further comprising:

selecting a media gateway at the control node in charge and sending the media gateway address in a backward direction to preceding control nodes if a user plane modification is necessary or a media gateway is needed for switching; and

forwarding the call setup request to a further succeeding control node if the control node in charge does not serve a terminating user equipment.

3. A method according to claim 1 or 2, wherein the first control node is one of a mobile services switching center, a gateway mobile services switching center, and a transit switching center.

4. A method according to claim 1, 2 or 3, further comprising transporting a list of CODECs provided by an originating user equipment through the wireless communications network to the terminating user equipment, the list of CODECs being used to select resources for payload modification, and after the selection of resources, adapting the payload modification according to said selected resources.

5. A method according to any of the claims 1 to 4, wherein the step of sending the list of CODECs comprises sending the list of CODECs within an initial address message.

6. A method according to any of the claims 1 to 5, further comprising the step of transporting a selected CODEC type from an originating user equipment to the terminating user equipment.

7. A method according to any of the claims 1 to 6, further comprising selecting a further CODEC responsive to the information about the

selected CODEC type, for further transcoding at the edge of a network and a user equipment to facilitate tandem free operation.

8. A method according to any of the claims 1 to 6, further comprising avoiding further transcoding within a network responsive to the information about the selected CODEC type.

9. A method according to any of the claims 1 to 8, further comprising the step of transporting a selected framing type through the network.

10. A method according to any of the claims 1 to 9, wherein the step of selecting the media gateway further comprises revoking the selection of media gateway performed by a preceding control node, wherein the revocation is sent in a backward direction to the preceding nodes.

11. A method according to any of the claims 1 to 10,wherein the step of revoking the media gateway further includes re-sending from the control node to the terminating user equipment the lists of CODECs received at the control node which performed the first selection of a media gateway, the list of CODECs being used to select resources for payload modification and after a selection being adapted according to the selected resources.

12. A method according to any of the claims 1 to 11, wherein the step of revoking the selection of the media gateway further comprises revoking selections of framing type, coding type and the media gateway address.

13. A method according to any of the claims 1 to 12, further comprising the step of reserving at the media gateway a logical point identifying reserved resources in the media gateway for handling the payload of a call, in response to a request for resources.

14. A method according to any of the claims 1 to 13, wherein the step of sending an address of the media gateway in a backward direction to the preceding control nodes further comprises transferring an identification of the logical point in the backward direction to the first control node.

15. A wireless communication network comprising:

plural control nodes, including a first control node and at least one further control node, the control nodes receiving information about a call, one of the further control nodes requesting resources from at least one media gateway (MGW), of plural media gateways, for handling a user plane of the call; and

the at least one media gateway including plural logical points for connecting

plural media gateway resources for handling the user plane of the call, the at least one media gateway being adapted to identify one of the logical points to the one of the further control nodes in response to a request for resources from the one of the further control nodes, whereby the plural control nodes use the at least one media gateway for handling the user plane of the call.

16. A wireless communication network according to claim 15 wherein the one of the further control nodes transfers an address for the media gateway in a backward direction to the preceding control nodes.

17. A wireless communication network according to claim 15 or 16, wherein the one of the further control nodes transfers information on the identified logical points for the media gateway in a backward direction to the preceding control nodes.

18. A wireless communication network according to claim 15, 16, or 17,wherein at least one of the plural media gateway resources is one of a transcoder, a conference call device a modem, a tone generator, or an announcement device.

19. A wireless communication network according to any of the claims 15 to 18,wherein the communication between the control node and the media gateway regarding the control and reservation of resources in said media gateway is performed using a Device Control Protocol.

20. A wireless communication network according to any of the claims 15 to 19, wherein the network uses an N-ISUP interface between the control nodes for call control.

21. A wireless communication network according to any of the claims 15 to 20,wherein the user plane is transferred compressed within and between media gateways.

22. A method of setting up a call in wireless communication network

with a separation of call control and bearer control, the call control being implemented in control nodes, the bearer control being implemented in at least one media gateway, comprising:

receiving a call setup request in a first control node;

receiving a list of transcoders in said first control node;

forwarding from the first control node the call setup request and the list of transcoders to a succeeding control node;

sending the media gateway address in a backward direction to preceding control nodes at the succeeding control node if at least one of a user plane modification is necessary and a media gateway is needed for switching; and

forwarding the call setup request and the list of transcoders if the control node does not serve a terminating user equipment, and further forwarding an address of the selected media gateway to a succeeding control node if a media gateway has been selected.

FIG. 1

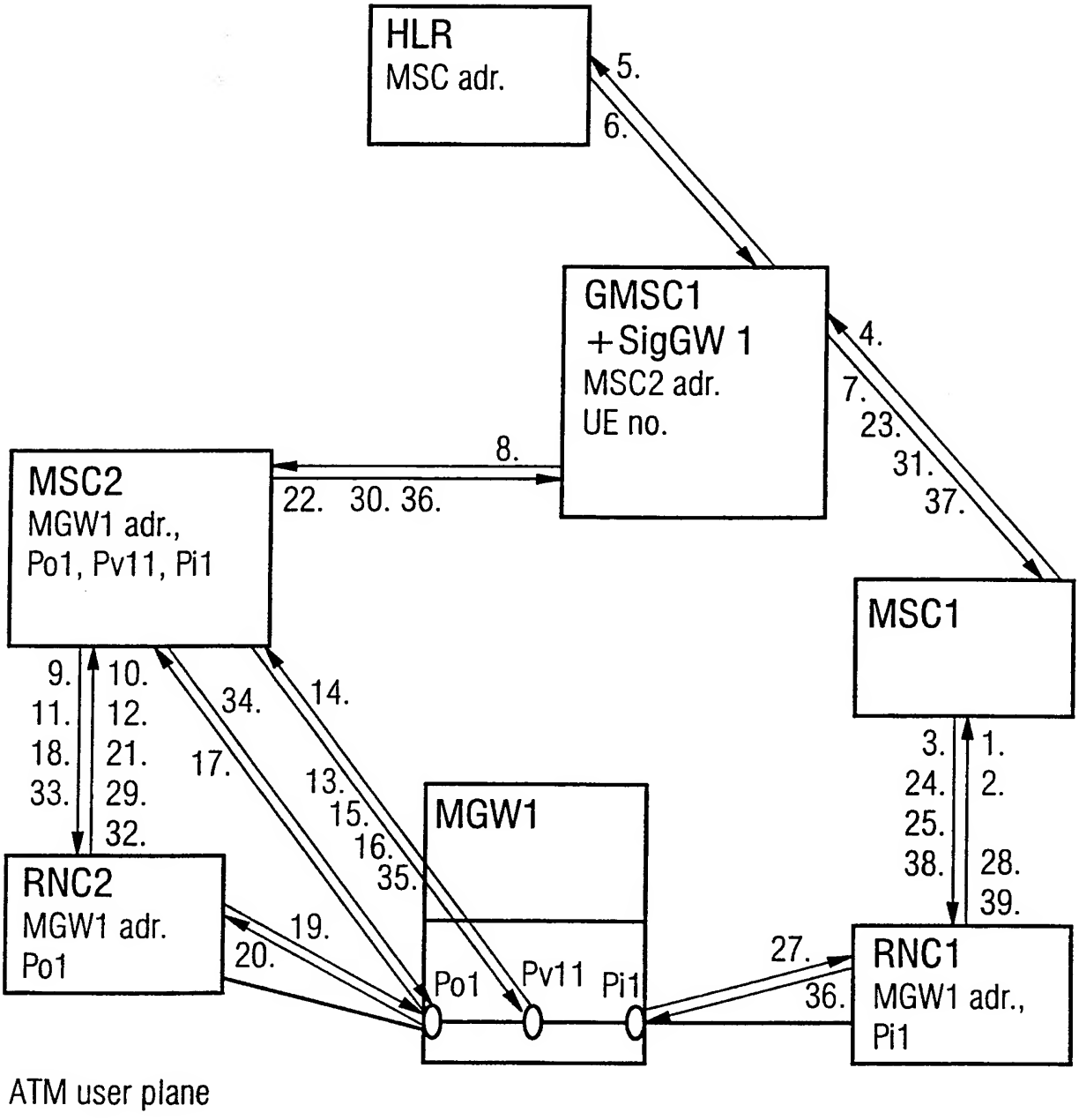
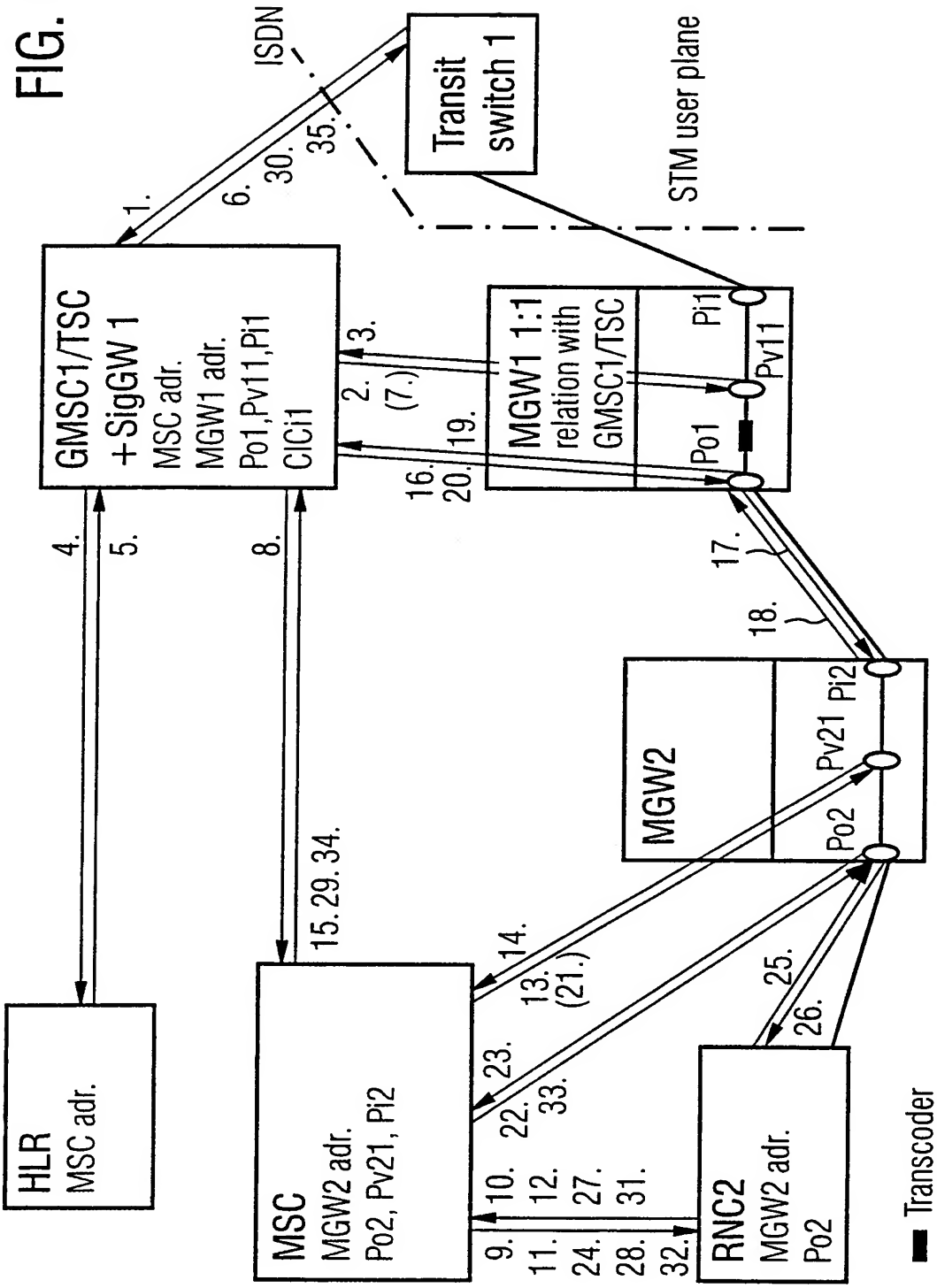

HLR
MSC adr.
5.
6.
GMSC1
+SigGW 1
MSC2 adr.
UE no.
4.
7.
23.
31.
37.
8.
22. 30. 36.
MSC2
MGW1 adr.,
Po1, Pv11, Pi1
MSC1
9.
11.
18.
33.
10.
12.
21.
29.
32.
34.
17.
14.
13.
15.
16.
35.
MGW1
3.
24.
25.
38.
1.
2.
28.
39.
RNC2
MGW1 adr.
Po1
19.
20.
27.
36.
Po1
Pv11
Pi1
RNC1
MGW1 adr.,
Pi1
ATM user plane

FIG. 2


ISDN
Transit switch 1
STM user plane
GMSC1/TSC
+SigGW 1
MSC adr.
MGW1 adr.
Po1,Pv11,Pi1
CICi1
MGW1 1:1
relation with
GMSC1/TSC
Pi1
Pv11
Po1
MGW2
Pv21
Pi2
Po2
HLR
MSC adr.
MSC
MGW2 adr.
Po2, Pv21, Pi2
RNC2
MGW2 adr.
Po2
Transcoder
1.
2.
(7.)
3.
4.
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13.
(21.)
14.
15.29.34.
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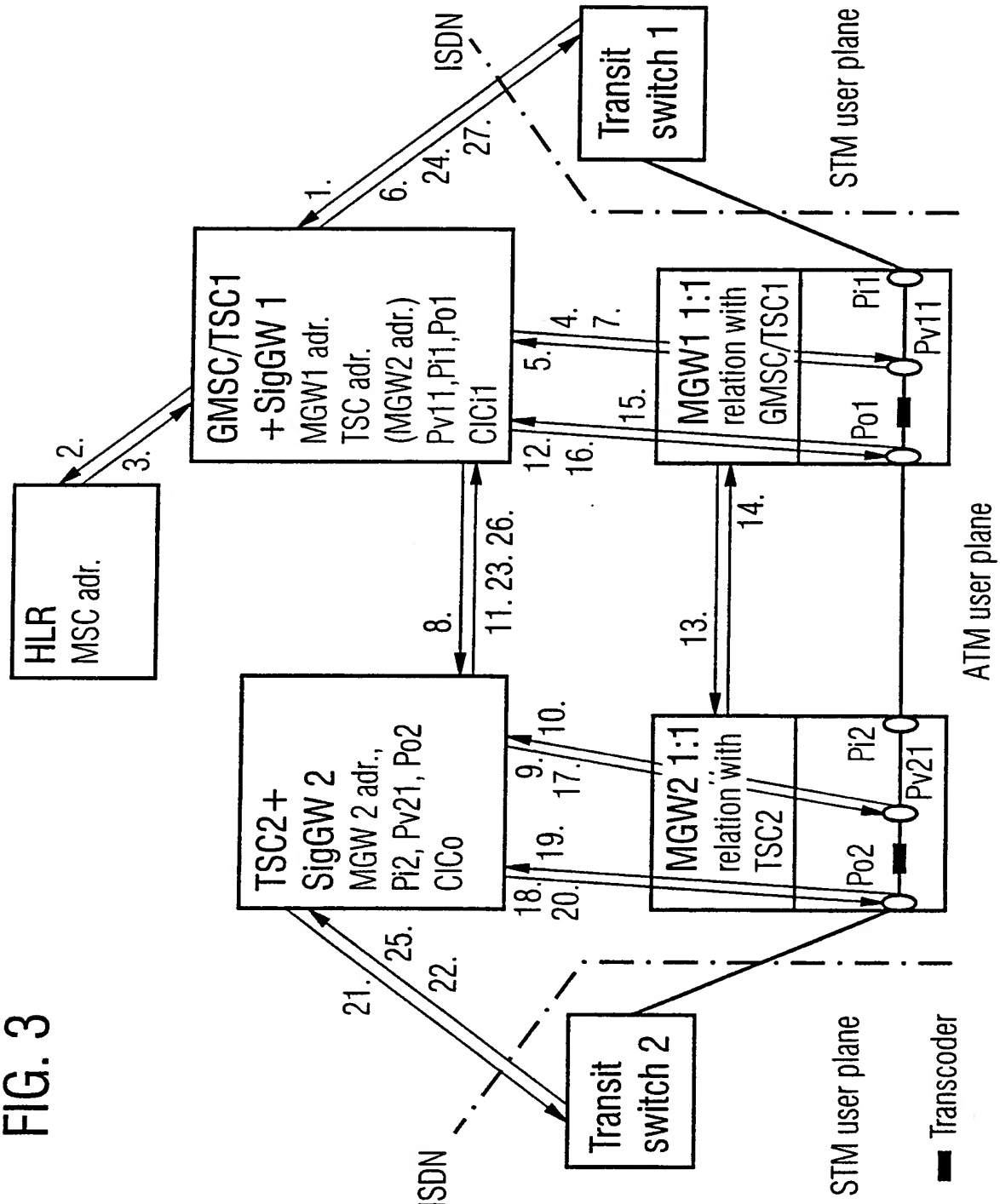
35.


HLR
MSC adr.
GMSC/TSC1
+SigGW 1
MGW1 adr.
TSC adr.
(MGW2 adr.)
Pv11,Pi1,Po1
CICi1
TSC2+
SigGW 2
MGW 2 adr.,
Pi2, Pv21, Po2
CICo
MGW1 1:1
relation with
GMSC/TSC1
MGW2 1:1
relation with
TSC2
Pi1
Pv11
Po1
Pi2
Pv21
Po2
Transit
switch 1
Transit
switch 2
ISDN
ISDN
STM user plane
STM user plane
ATM user plane
Transcoder
1.
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11. 23. 26.
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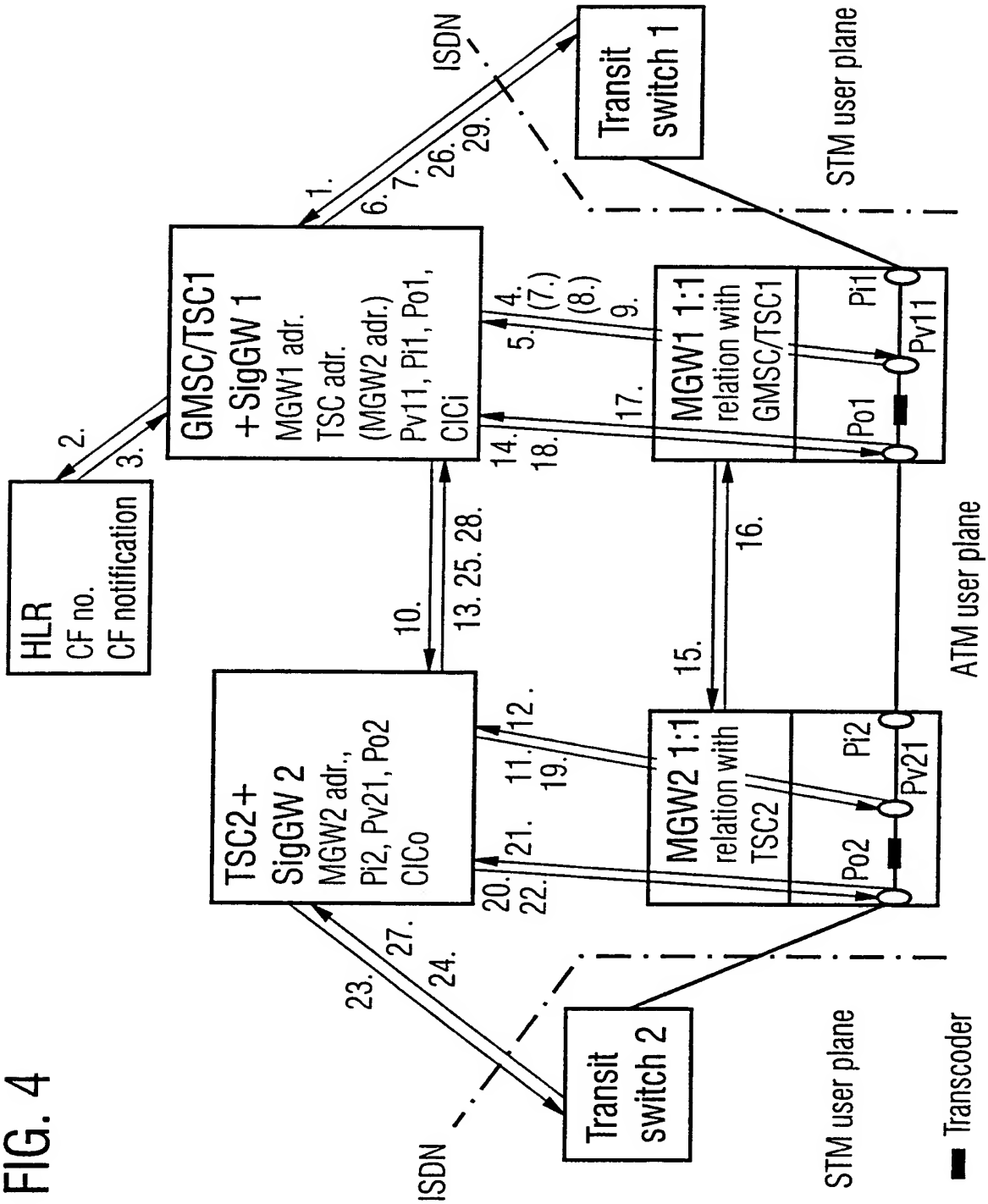
24.
25.
27.

FIG. 3


HLR
CF no.
CF notification
GMSC/TSC1
+SigGW 1
MGW1 adr.
TSC adr.
(MGW2 adr.)
Pv11, Pi1, Po1,
CICi
TSC2+
SigGW 2
MGW2 adr.,
Pi2, Pv21, Po2
CICo
MGW1 1:1
relation with
GMSC/TSC1
MGW2 1:1
relation with
TSC2
Pi1
Pv11
Po1
Pi2
Pv21
Po2
Transit
switch 1
Transit
switch 2
ISDN
ISDN
STM user plane
STM user plane
ATM user plane
Transcoder
1.
2.
3.
4.
5.
(7.)
(8.)
9.
10.
11.
12.
13. 25. 28.
14.
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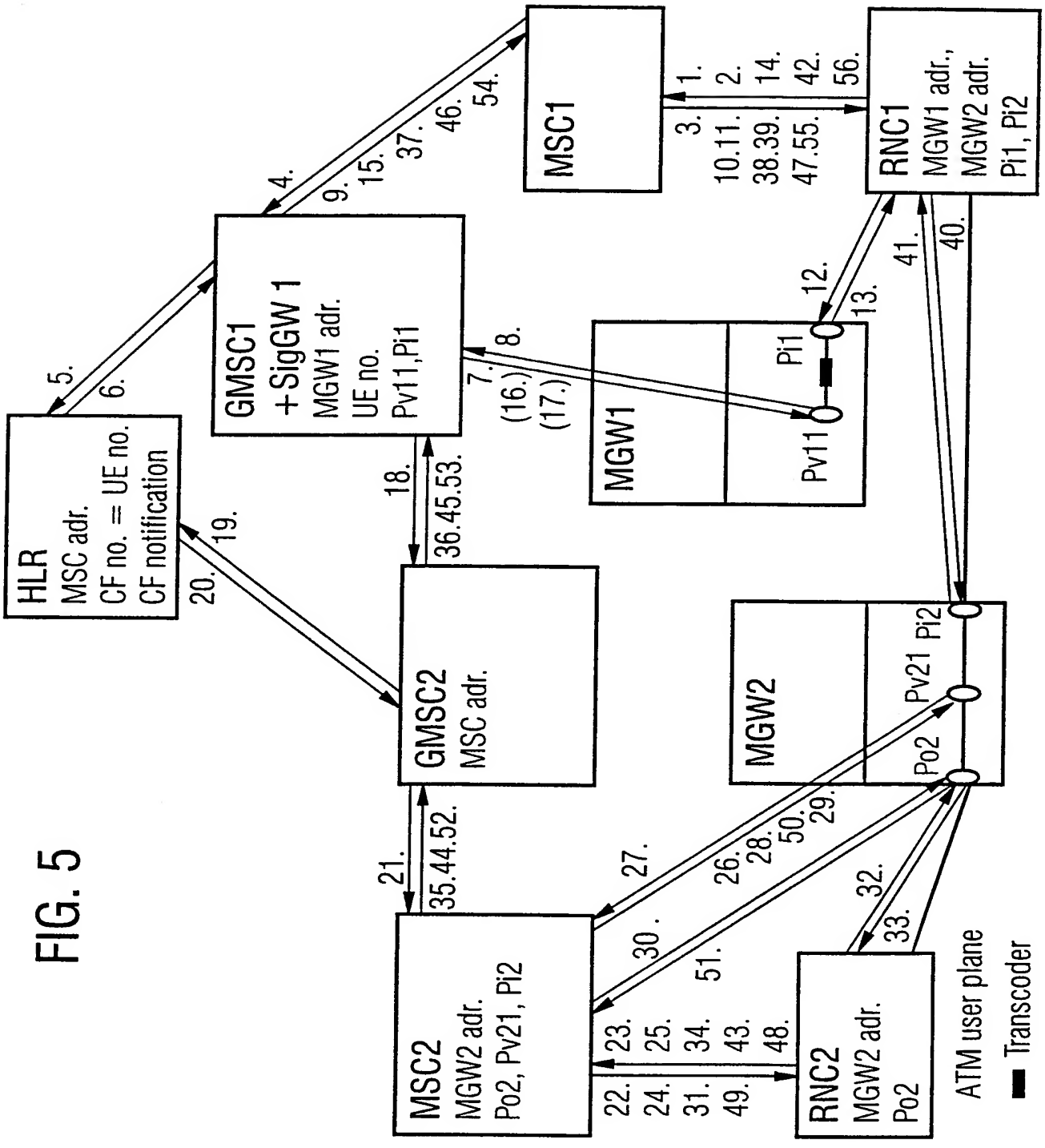
29.
6.

FIG. 4


HLR
MSC adr.
CF no. = UE no.
CF notification
GMSC1
+SigGW 1
MGW1 adr.
UE no.
Pv11,Pi1
MSC1
RNC1
MGW1 adr.,
MGW2 adr.
Pi1, Pi2
MGW1
Pi1
Pv11
GMSC2
MSC adr.
MGW2
Pv21
Pi2
Po2
MSC2
MGW2 adr.
Po2, Pv21, Pi2
RNC2
MGW2 adr.
Po2
1.
2.
3.
10.11.
14.
38.39.
42.
47.55.
56.
4.
9.
15.
37.
46.
54.
5.
6.
7.
8.
(16.)
(17.)
12.
13.
41.
40.
18.
36.45.53.
19.
20.
21.
35.44.52.
27.
26.
28.
50.
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51.
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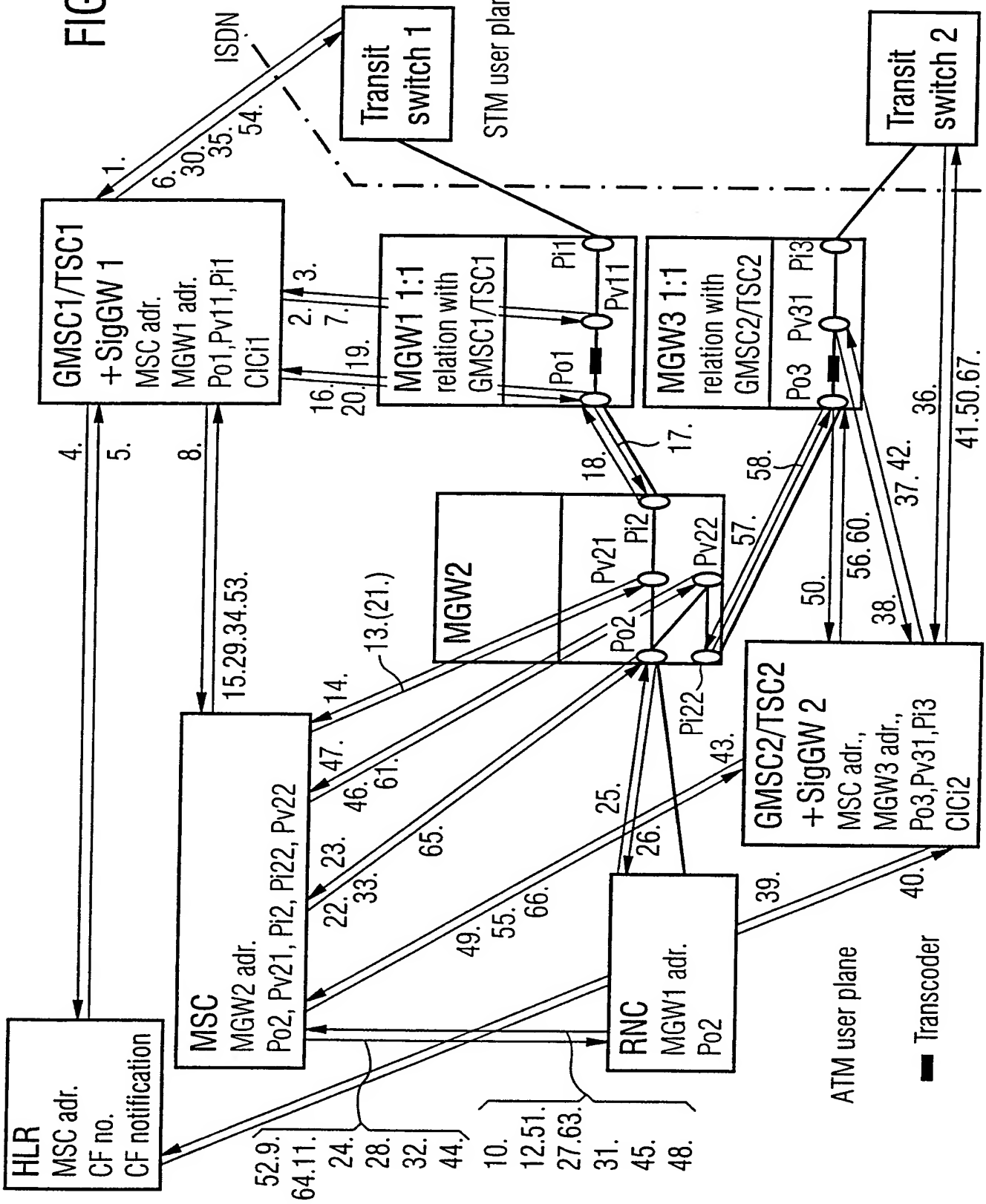
34.
49.
43.
48.
ATM user plane
Transcoder

FIG. 5

FIG. 6


ISDN
Transit switch 1
STM user plane
Transit switch 2
GMSC1/TSC1 +SigGW 1
MSC adr.
MGW1 adr.
Po1,Pv11,Pi1
CICi1
MGW1 1:1 relation with GMSC1/TSC1
Pi1
Pv11
Po1
MGW3 1:1 relation with GMSC2/TSC2
Pi3
Pv31
Po3
MGW2
Pv21
Pi2
Pv22
Po2
MSC
MGW2 adr.
Po2, Pv21, Pi2, Pi22, Pv22
15.29.34.53.
RNC
MGW1 adr.
Po2
Pi22
GMSC2/TSC2 +SigGW 2
MSC adr.,
MGW3 adr.,
Po3,Pv31,Pi3
CICi2
HLR
MSC adr.
CF no.
CF notification
ATM user plane
Transcoder
1. 6. 30. 35. 54.
2. 3. 7. 16. 19. 20.
4. 5. 8.
13.(21.) 14. 47. 46. 61. 22. 23. 33. 65.
17. 18.
58. 57.
50. 56. 60. 38. 37. 42. 36. 41. 50. 67.
25. 26. 43. 49. 55. 66. 39. 40.
52.9. 64.11. 24. 28. 32. 44.
10. 12.51. 27.63. 31. 45. 48.

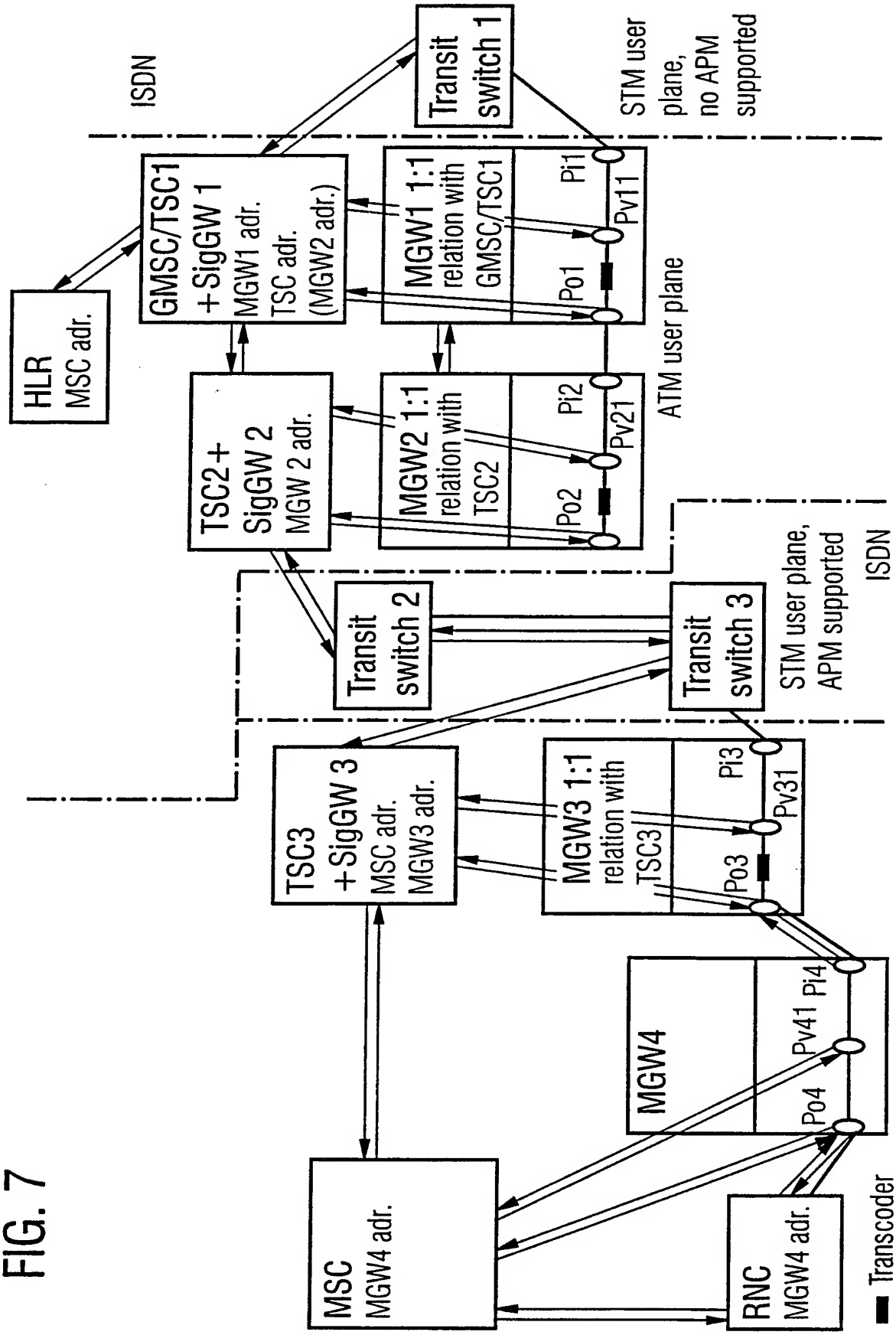

ISDN
Transit switch 1
STM user plane, no APM supported
GMSC/TSC1 + SigGW 1 MGW1 adr. TSC adr. (MGW2 adr.)
MGW1 1:1 relation with GMSC/TSC1
Pi1
Pv11
Po1
HLR MSC adr.
ATM user plane
TSC2+ SigGW 2 MGW 2 adr.
MGW2 1:1 relation with TSC2
Pi2
Pv21
Po2
Transit switch 2
Transit switch 3
STM user plane, APM supported
ISDN
TSC3 +SigGW 3 MSC adr. MGW3 adr.
MGW3 1:1 relation with TSC3
Pi3
Pv31
Po3
MGW4
Pv41
Pi4
Po4
MSC MGW4 adr.
RNC MGW4 adr.
Transcoder

FIG. 7

INTERNATIONAL SEARCH REPORT

Inte. ɔnal Application No
PCT/EP 00/06767

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 878 347 A (JOENSUU ERKKI ET AL) 2 March 1999 (1999-03-02) column 3, line 1 - line 35 column 4, line 16 -column 6, line 52	1,15,22
A	KNIGHT R R ET AL: "THE CALL CONTROL PROTOCOL IN A SEPARATED CALL AND BEARER ENVIRONMENT" BT TECHNOLOGY JOURNAL,GB,BT LABORATORIES, vol. 16, no. 2, 1 April 1998 (1998-04-01), pages 75-86, XP000750520 ISSN: 1358-3948 page 75, right-hand column, line 1 -page 77, right-hand column, line 46 page 82, left-hand column, line 1 -page 85, left-hand column, line 5	1,15,22

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 October 2000	07/11/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Lõpez-Pérez, M-C

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INTERNATIONAL SEARCH REPORT

Inter. nal Application No
PCT/EP 00/06767

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
E	EP 1 039 767 A (ERICSSON TELEFON AB L M) 27 September 2000 (2000-09-27) column 1, line 53 -column 3, line 30 column 4, line 1 -column 5, line 17 column 6, line 7 -column 12, line 20	1-3,9, 13-20,22

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte onal Application No
PCT/EP 00/06767

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5878347 A	02-03-1999	AU 2344597 A	17-10-1997
		CN 1229566 A	22-09-1999
		EP 0890283 A	13-01-1999
		WO 9736450 A	02-10-1997
		AU 2661497 A	17-10-1997
		EP 0890287 A	13-01-1999
		WO 9736451 A	02-10-1997
		US 5839072 A	17-11-1998
EP 1039767 A	27-09-2000	WO 0060887 A	12-10-2000